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Lou 13-13

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

**Patent Application**

Applicant(s): Hui-Ling Lou et al.

Case: 13-13

Serial No.: 09/390,389

Filing Date: September 3, 1999

Group: 2631

Examiner: Kevin Michael Burd

I hereby certify that this paper is being deposited on this date with the U.S. Postal Service as first class mail addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Signature: Louise M. Haslett Date: May 28, 2002

Title: Multiplier-Free Methods and Apparatus for Signal  
Processing in a Digital Communication System

TRANSMITTAL OF FORMAL DRAWINGS **RECEIVED**

Assistant Commissioner for Patents  
Washington, D.C. 20231

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Sir:

Applicants submit herewith eight (8) sheets of formal drawings in the above-referenced patent application.

Respectfully submitted,

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Date: May 28, 2002

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FIG. 1(a)

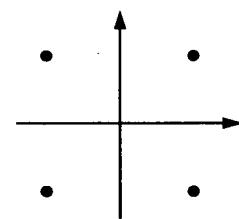


FIG. 1(b)

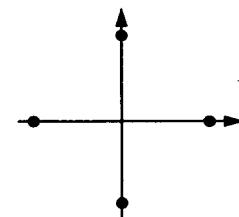


FIG. 2

$b_1$	$b_0$	$u$
0	0	1
0	1	$j$
1	0	-1
1	1	$-j$

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FIG. 3

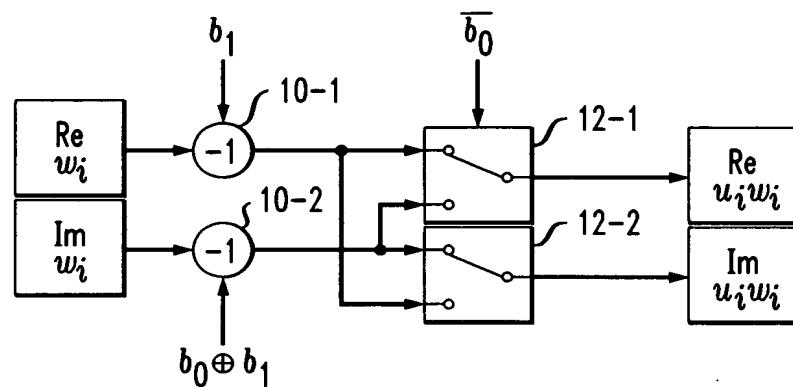
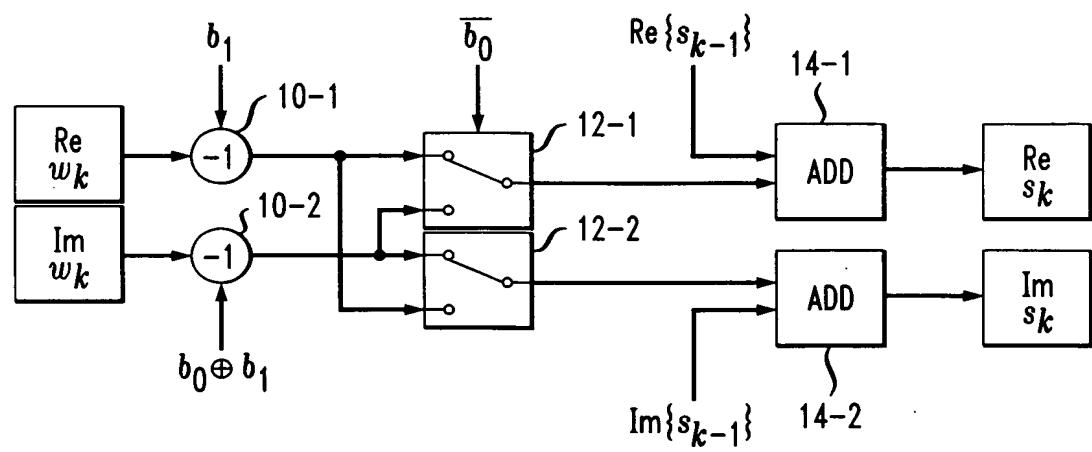


FIG. 4



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FIG. 5

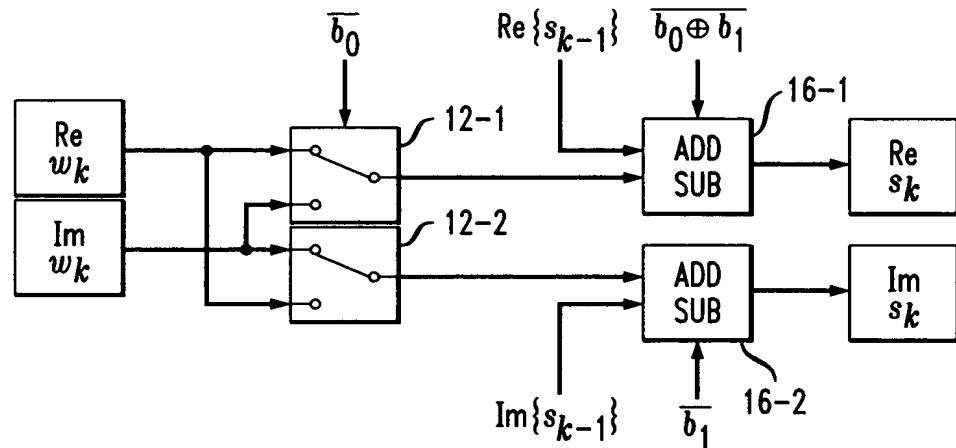
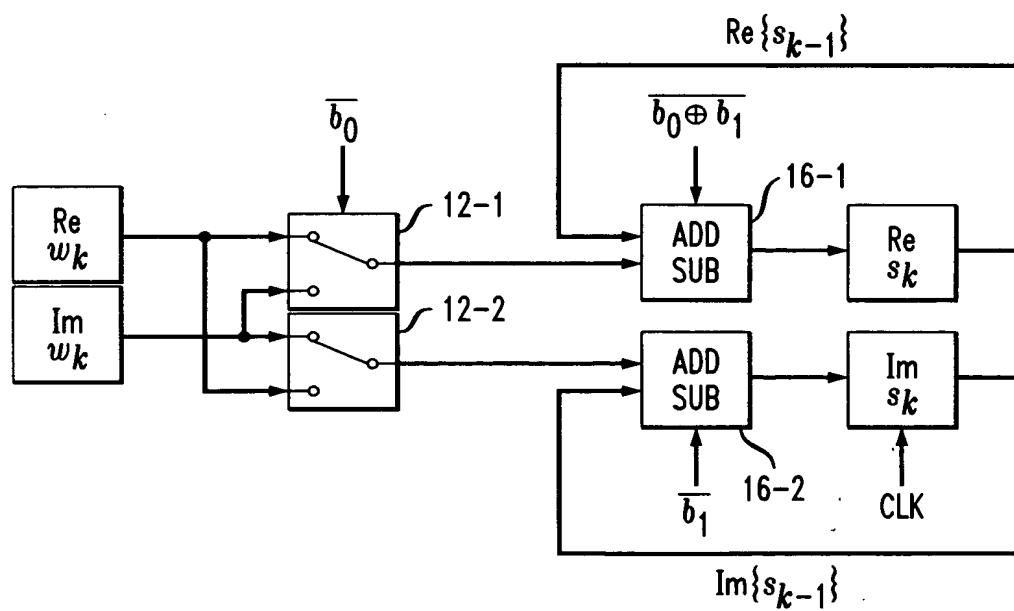


FIG. 6



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FIG. 7(a)

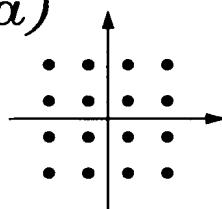


FIG. 7(b)

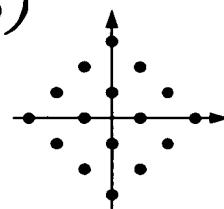


FIG. 7(c)

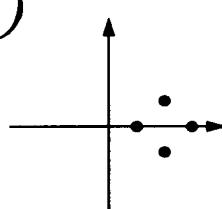


FIG. 7(d)

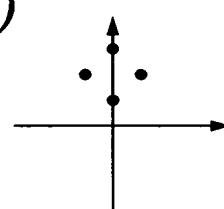


FIG. 7(e)

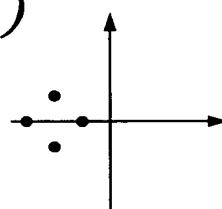


FIG. 7(f)

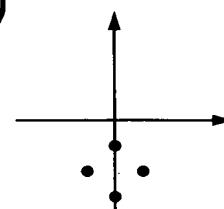
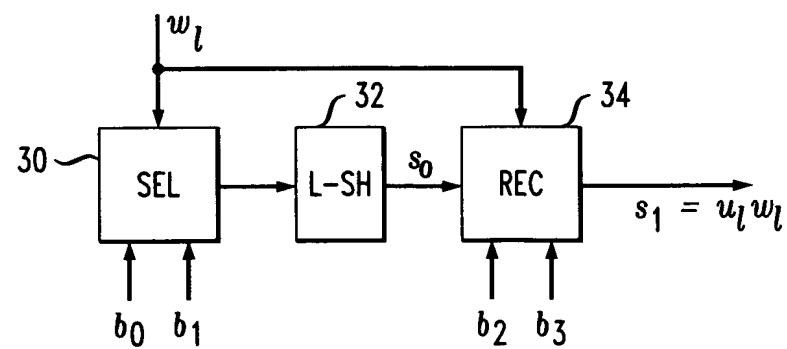


FIG. 8



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FIG. 9

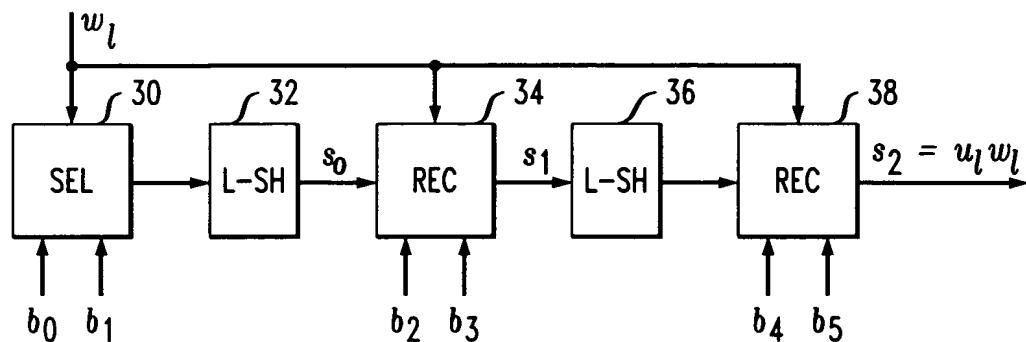
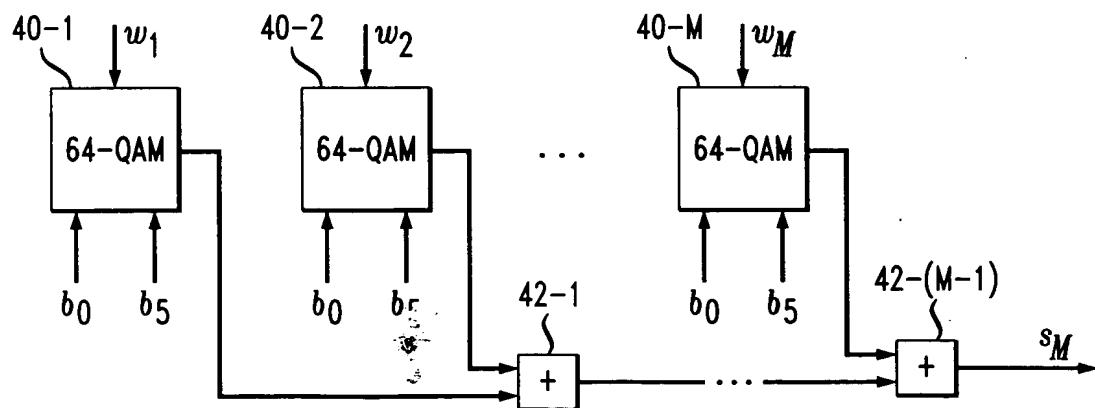


FIG. 10

	SECTION 1.1	CONVENTIONAL
MODULATION	NO. OF ADD/SUB OPERATIONS	NO. OF ADD & MULTIPLY
QPSK	$2M - 2$	$(4M-2)$ & 4M
16-QAM	$3M - 2$	$(4M-2)$ & 4M
64-QAM	$4M - 2$	$(4M-2)$ & 4M
256-QAM	$5M - 2$	$(4M-2)$ & 4M
1024-QAM	$6M - 2$	$(4M-2)$ & 4M

FIG. 11



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FIG. 12

$S(A)$	$S(B)$	op	$Z$	$S(Z)$
+	+	$A + B$	$A + B$	+
+	-	$A - B$	$A - B$	+
-	+	$B - A$	$B - A$	+
-	-	$-A - B$	$A + B$	-

FIG. 13

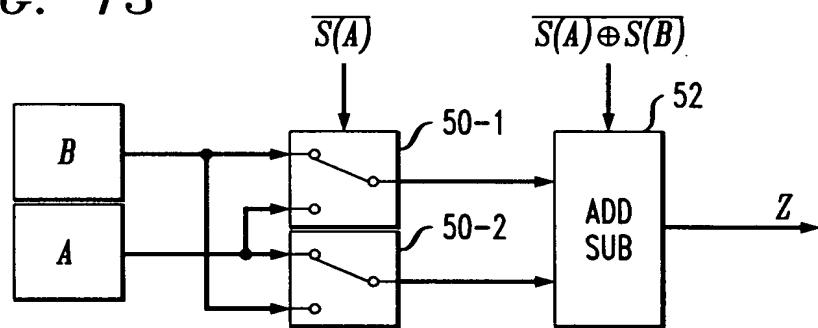
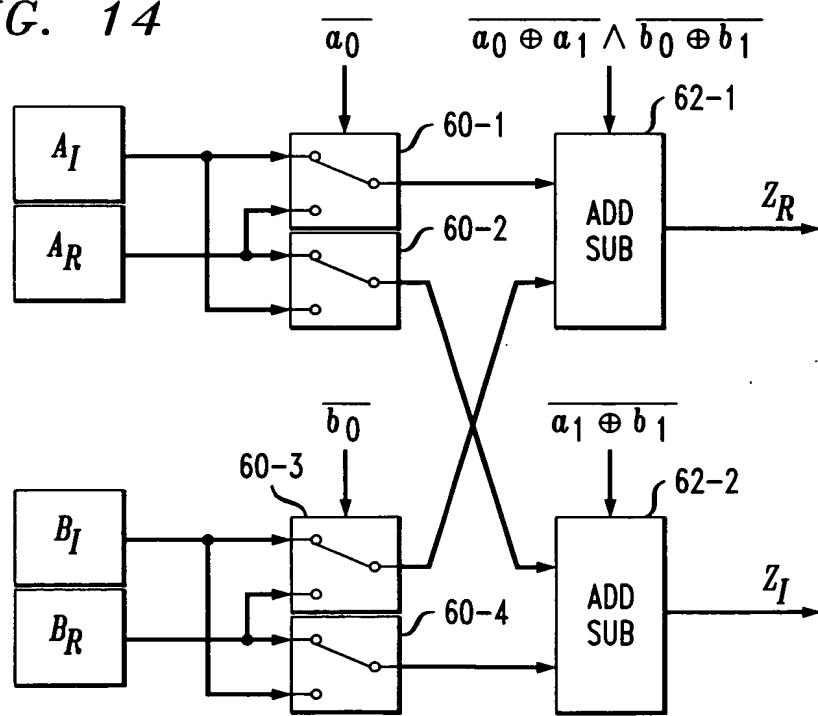


FIG. 14

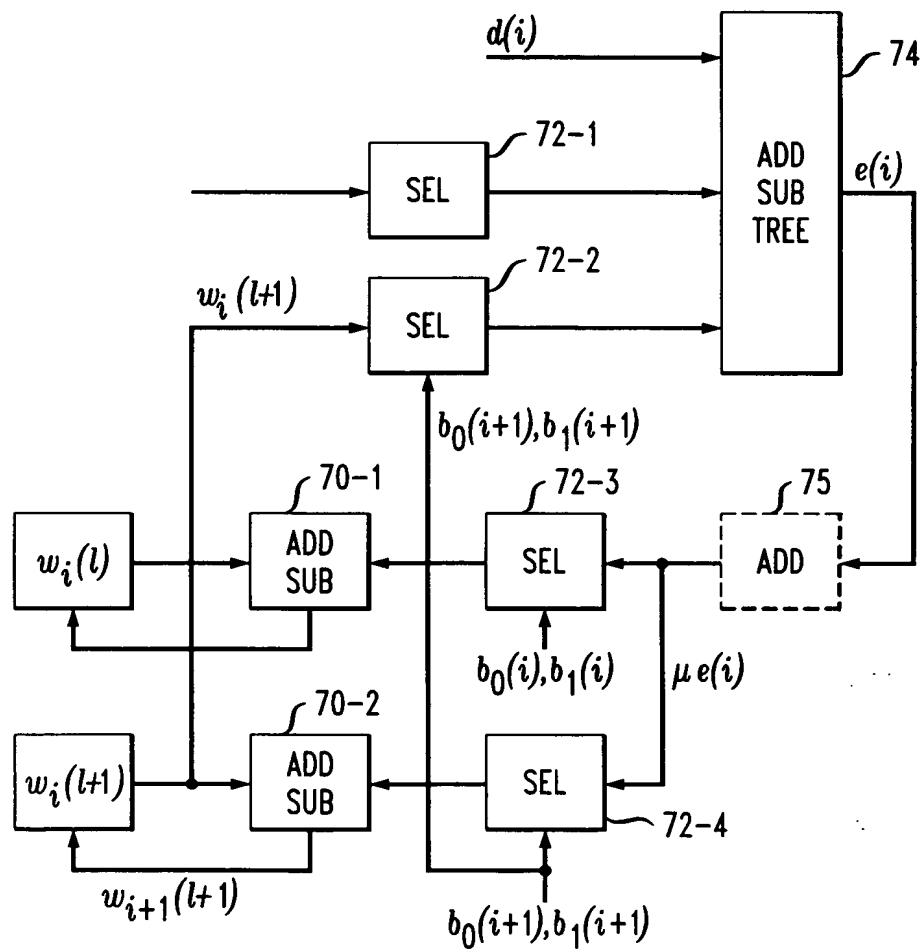


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FIG. 15

MODULATION	COMPLEXITY	MINIMUM LATENCY
QPSK	$4M$	$2 + \log_2 M$
16-QAM	$8M$	$4 + \log_2 M$
64-QAM	$12M$	$6 + \log_2 M$

FIG. 16



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FIG. 17

MODULATION	CONVENTIONAL	SECTION 1.1	MINIMAL OPERATIONS (SECTION 1.2)
QPSK	$2 \times 4 = 8$	0	0
16-QAM	$4 \times 16 = 64$	32	14
64-QAM	$4 \times 64 = 256$	160	68

FIG. 18

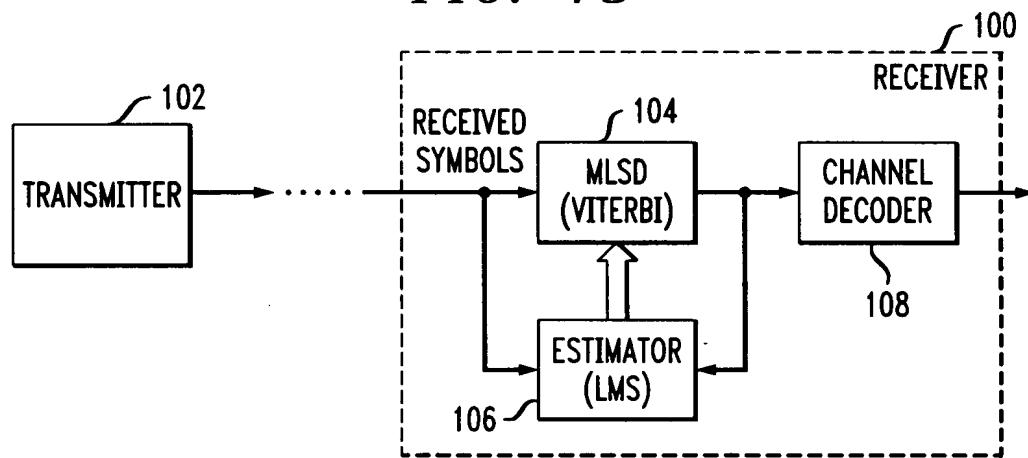


FIG. 19

